

**Example 1.4.12** Find  $(f \circ g)(3)$  and  $(g \circ f)(-2)$  when  $f(x) = x^2 - 1$  and  $g(x) = 2x - 3$ .

$$\begin{aligned}(f \circ g)(3) &= f(g(3)) \\ &= f(2(3) - 3) \\ &= f(3) \\ &= (3)^2 - 1 \\ &= 8\end{aligned}$$

$$\begin{aligned}(g \circ f)(-2) &= g(f(-2)) \\ &= g((-2)^2 - 1) \\ &= g(3) \\ &= 2(3) - 3 \\ &= 3\end{aligned}$$

**Example** Find  $f(g(x))$  and  $g(f(x))$  if  $f(x) = 1/(x - 1)$  and  $g(x) = \sqrt{x}$ . State the domain of each.

$$\begin{aligned}f(g(x)) &= f(\sqrt{x}) \\ &= \frac{1}{\sqrt{x} - 1}\end{aligned}$$

The domain of  $f(g(x))$  is  $x \in [0, 1) \cup (1, \infty)$ .

$$\begin{aligned}g(f(x)) &= g\left(\frac{1}{x-1}\right) \\ &= \sqrt{\frac{1}{x-1}} \\ &= \frac{1}{\sqrt{x-1}}\end{aligned}$$

The domain of  $g(f(x))$  is  $x \in (1, \infty)$ .